APPENDIX B

CHRONOLOGY OF EVENTS
DICKSON COUNTY LANDFILL

(22 Pages)

APPENDIX B

CHRONOLOGY OF EVENTS
DICKSON COUNTY LANDFILL

The following documents were reviewed to gain an understanding of events at the Dickson County Landfill. The documents are described in chronological order. The source of each document is provided at the end of each description followed by the file from which the document was obtained in parentheses.

1968 — The landfill opened as the city dump. While it operated as a dump, several local industries reportedly disposed of trailer loads of drums in the dump. The drums contained solvents, paint wastes, and known wastes. Ebbtide (Winner Boats) and Schrader Automotive Group disposed of drummed wastes by the trailer load every week for a period of 3 to 4 years. The contents of the drums were suspected to be solvents used to harden fiberglass. Schrader Automotive Group was thought to have dumped drums of waste solvents used to degrease automotive parts. Schrader also dumped waste at the Dickson dump from a state-enforced cleanup of its facilities in several other areas of the country. (Ref. Halliburton NUS Environmental Corporation, Superfund Division Final Report - Site Inspection) Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

March 19, 1975 — In 1975, a geologic evaluation of the proposed additional acreage was performed by the TDPH. The report concluded, "most of the site appears suitable for use as a sanitary landfill." The report recommended the following: no liquid wastes to be disposed of; no cuts below 820 feet mean sea level (msl) until the possibility of "seepages" is disproved; maximum cut depth of 20 feet due to increase of chert content in the soil; sampling of water wells within a 0.5-mile radius to determine background quality; waste covering, compacting, and drainage control; cuts allowable to 800 feet msl if no perched groundwater is present; and a 20-foot soil buffer above any perched groundwater. Source: Geologic Evaluation, by Craig Sprinkle, DSWM, March 19, 1975, (DSWM).

1977 — County purchased the property and an additional 45 acres for use as a sanitary landfill. After the sanitary landfill was opened, the landfill accepted only industrial wastes permitted by Tennessee Department of Environment and Conservation (TDEC) Division of Solid Waste Management (DSWM) and domestic wastes. The industrial wastes accepted at the landfill include wastes from Ebbtide's own dumps during a state-wide cleanup of that facility, Spotleak (a Mercaptan-sulfur compound mixture), excavated soil from an underground storage tank remediation (contaminated with benzene), toluene, ethylbenzene, xylene, and petroleum hydrocarbons, and waste from an aluminum foundry. Monitoring wells were installed and tested sporadically during operation of the landfill. Wastes accepted by the sanitary landfill include unknown amounts of waste oil and coolants from the Teksid Aluminum Foundry. (Ref. Halliburton NUS Environmental Corporation, Superfund Division Final Report - Site Inspection). Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC Nashville Environmental Assistance Center (NEAC) (DSWM, NEAC).

January 17, 1986 — A preliminary assessment of the site as a potential hazardous waste site was completed. The report described historical waste disposal practices, geologic conditions, population served, and water supplies. The landfill was operated by the City from 1968 to 1977, and then "turned over to the County in 1977." Information on the water supply distribution include the following: Turnbill Utilities sells water to Dickson; Dickson has one active well and one in reserve; Dickson also uses Dickson Lake; West Piney Utilities serves the area around the landfill, and they buy water directly from Dickson. Mr. Reeder of West Piney Utilities stated that most of the water supplied to West Piney would come from Dickson Lake. The report concluded that "due to the fact that the city water southwest of Dickson is taken from Dickson Lake and the residents in the area utilize groundwater, this site should be given a medium priority." Source: Preliminary Assessment as a Potential Hazardous Waste Site, (TDEC).

August 4, 1987 — A soil boring investigation was performed to assess the conditions of the soil and groundwater for a landfill extension. Six borings were advanced using hollow-stem augers and mud-wash drilling techniques. The reports indicated that groundwater was encountered at less than 50 feet in all cases. Sand and gravelly chert was prevalent in all borings. The borings were terminated prior to refusal. Source: Law Engineering Report to Gardner Engineering, August 4, 1987 (DSWM, NEAC).

August 17, 1987 — Memorandum to file from DSWM discussing regulatory review of the Law Engineering soil boring data for the six borings. The report states the first groundwater was a perched zone that "could be from a large perched system over the site...." "The water levels at present rule out the use of this site for a landfill," unless further investigations distinguish between a perched system and "actual groundwater conditions." Source: Memorandum to file by Mr. William Krispin, DSWM, August 17, 1987 (DSWM, NEAC).

October 19, 1987 — Memorandum to file from DSWM that accepts the site as a suitable disposal location after the information provided by the Soil Conservation Service indicated the presence of a perched zone above a fragipan. Source: Memorandum to file by Mr. William Krispin, DSWM (DSWM, NEAC).

October 23, 1987 — Letter from the Tennessee Department of Health and Environment (TDHE) to the City (or County) that approves the site as being suitable for a landfill extension with certain restrictions. Source: Letter to Mr. Virgil Bellar from Mr. Mark McWhorter of the DSWM, October 23, 1987 (DSWM, NEAC).

February 1988 — An operations manual prepared for the landfill. Information in the manual is as follows: the current volume was 1,572 tons per week; the filling was initially done in a trench with three additional lifts; and four wells were to be sampled for pH, specific conductance, total organic carbon (TOC), nitrate nitrogen, chloride, lead, chromium (total), cadmium, iron, and manganese. Source: Operations Manual for 1988 Landfill Extension, February 1988, Gardner Engineering (DSWM, NEAC).

July 25, 1988 — Letter from county resident (Ann Sullivan) on Furnace Hollow Road requesting that the Department sample the spring on her property. The spring provides water for drinking at the residence and for cattle. A telephone conversation apparently followed on August 5, 1988. Source: Letter from Ann Sullivan to Department, received July 25, 1988 (DSWM, NEAC).

Sept. 19, 1988	Meeting summary developed for the September 19, 1988, public hearing for the proposed landfill extension. Numerous residents made comments. One resident, Ann Sullivan, refers to Worley Furnace Creek, from which her cattle drink, as being "contaminated." Source: Public Hearing summary (DSWM, NEAC).
October 1988	Response to public hearing comments stating that there is no "indication of contamination by the existing landfill. The City of Dickson monitors water quality at their well approximately 1000 feet Northeast of the landfill and at the confluence of West and East Piney Rivers. Their sampling does not indicate any contamination from the existing landfill." Source: Response to Public Hearing Comments (DSWM, NEAC).
October 3, 1988	Letter from Mr. Lester Randles, a resident who opposes the landfill. The letter claims that Bruce Spring has been polluted by the existing landfill based on algae growth starting in 1984. Source: Letter from Mr. Lester Randles to Mr. Tom Teisler, DSWM (DSWM, NEAC).
October 12, 1988	Copies of the analytical results for the spring and well sampling at the Dale Donegan Spring, the Harry Holt well, and the Lavenia Holt well. According to the reports, methylene chloride was detected in the Donegan Spring (0.003 μg/L) and the Lavenia Holt well (0.5 μg/L); and TCE was detected in the Harry Holt well (3.5 μg/L). Sources: Analytical Reports from the TDHE laboratory (DSWM, NEAC).
Dec. 3, 1988	A letter from U.S. EPA to Mr. Harry Holt that discusses the results of well sampling for VOCs. The letter concludes that although one sample contained TCE above the MCL (0.26 mg/L) and a second sample contained TCE slightly below (0.0039 mg/L) the MCL, the EPA concluded that "there were no constituents detected which exceeded EPA's National Primary Drinking Water Regulations or any other health-based criteria. As such, use of your well water should not result in any adverse health effects". Source: Letter to Mr. Harry Holt from Mr. Wayne Aronson, Drinking Water Section, U.S. EPA (U.S. EPA Disk 1).
Dec. 8, 1988	TDHE sampled the Holt well, and the results indicated the water was of good quality. Methylene chloride and TCE were detected but were noted by the TDHE as "probably a laboratory error." Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
July 17, 1990	An unknown private well that previously detected trichloroethylene (26 and 3.9 parts per billion) was resampled. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
January 28, 1991	An EPA potential hazardous waste site inspection of the landfill was performed. Waste types identified in the report include: oily waste (from Aluminum foundry), solvents (from Schrader Automotive and Winner Boats), and pesticides. Hazardous substances identified at the landfill include: trichloroethane (drums), gamma-chlordane, alpha-chlordane, dichlorodiphenyltrichloroethane, chloroform, carbon disulfide. A description of hazardous conditions and incidents at the landfill includes the following: landfill had several leachate areas that entered the surface water pathway. Schrader Automotive and Winner Boats supposedly brought trailer loads of drummed waste-degreasers, solvents, and paint waste. The report stated that

elevated levels of several pesticides were detected within the landfill. The total population potentially affected was 30,615. Questionable material was placed in the city dump prior to 1973. The private well was contaminated with TCE, and two municipal wells are within 4,000 feet. There is a surface water intake on the West Piney River within the 15-mile surface water pathway. A landfill attendant supposedly attempted to open a drum from the Ebbtide Company (Winner Boats), but it exploded. Soils within the landfill were contaminated with high levels of pesticides, metals, and unidentified organics. Mr. Holt owns a home approximately 500 feet east of the landfill, and his private well was contaminated with TCE. The landfill is still active; however, the old dump is not used. The area is not fenced, and pedestrian traffic is possible. A landfill directly adjacent to the old city dump to the west is presently being used. Most waste was in drums and the old city dump is not lined. Two municipal wells are located 4,000 feet east of the landfill. Past response activities include the following: drums from Winner Boats containing acetone, paint waste, and rainwater were removed from the dump (date unknown). Enforcement information: the state had several notices of unsatisfactory cover, dead animals, and people going through trash. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

October 10, 1991 The Final Report - Site Inspection was completed by Halliburton NUS Environmental Corporation, Superfund Division. The organic analytical summary within the report identified elevated levels of pesticides from a sample taken from the middle portion of the landfill. Unidentified extractables were found in all the surface soil samples. Pesticides were also detected in a subsurface sample (gamma-chlordane/2 and alpha-chlordane/2) as well as methyl ethyl ketone. Chloroform along with evidence of petroleum product, and low levels of several polyaromatic hydrocarbons were also detected. Unidentified extractables were found in all sediment samples. A number of leachate samples contained unidentified extractable organics. Elevated levels of TCE were detected in one groundwater sample. The inorganic analytical summary identified few inorganics at elevated levels in soils. One sample contained elevated levels of copper and zinc, two others contained elevated levels of calcium, and a final sample had an elevated level of zinc. A variety of inorganics were identified in surface water samples. A sample collected from Worley Furnace Creek contained aluminum, iron, barium, vanadium, zinc, and magnesium. A sample collected from a runoff pipe in the center of the landfill showed elevated levels of barium, iron, sodium, potassium, and magnesium. Surface water taken from a creek just south of the landfill contained elevated levels of calcium, barium, magnesium, potassium, and sodium. Sediment samples did not contain elevated levels of inorganics except for two samples. One had elevated aluminum, magnesium, and potassium, and the other had elevated calcium and magnesium. Leachate samples collected at the site contained zinc in one sample and elevated levels of potassium, magnesium, lead, and aluminum in another sample. Groundwater from well MW-02 contained elevated levels of iron, copper, barium, nickel, vanadium, manganese, and aluminum. Groundwater from well PW-01A contained elevated levels of copper, strontium, and titanium. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

October 10, 1991 Final Site Inspection Report for the Dickson County Landfill was prepared by NUS Corporation. The conclusions of the report included the following: the primary contaminants of concern are pesticides within the landfill, heavy metals in the extended surface water pathway, and TCE in the private well 500 feet east of the landfill. The report recommended that the site be evaluated using the Hazard Ranking System (HRS). Source: Final Site Inspection Report, NUS Corporation, October 10, 1991 (TDEC).

Dec. 17, 1991 A letter from TDEC DWS to U.S. EPA states concern that the sampling of the Harry Holt well may not be representative of the actual conditions or health threat. Specifically, "our program is concerned that sampling twice with one considerably above MCL and one slightly below MCL in a karst area such as Dickson is in no way an assurance that Mr. Holt's well water will stay below the MCLs." Source: Letter to Mr. Nathan Sykes of U.S. EPA from Mr. Tom Moss, DWS, December 17, 1991 (U.S. EPA Disk 1).

January 6, 1992 Memorandum to file from DWS to document a phone conversation with Mr. Lofton Carr, U.S. EPA, regarding the Holt well. The call was in response to the December 17, 1991, letter to Mr. Nathan Sykes. Mr. Carr agreed that the well should continue to be sampled; however, "he was not in a position to sample Mr. Holt's well again even though it had sporadically shown TCE contamination above MCLs." Mr. Carr suggested contacting Mr. Nathan Sykes to inquire why he felt that monitoring was not necessary. Source: Memorandum to file from Mr. Tom Moss, DWS (DSWM, NEAC).

February 12, 1992 Letter to file from DSWM regarding the Holt well results. The memorandum states that there was "no substantial evidence" to support that the well had been contaminated by the landfill. The memorandum attaches a December 8, 1988, letter from the DSWM to Ms. Lavenia Holt stating that levels of methylene chloride and TCE in a sample collected from her well were "maybe due to either laboratory or sampling error." Source: Memorandum to file by Ms. Debbie Sanders, DSWM, February 12, 1992, (DSWM, NEAC)

February 12, 1992 TDEC internal correspondence regarding a record search of Holt well information. The records search indicated five descriptions of sampling activities in 1988. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

March 3, 1992 TDEC internal correspondence regarding the testing of the Holt well in July 1991. The correspondence indicates that the analysis showed no parameters that exceeded EPA Drinking Water Regulations. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

March 13, 1992 — A memorandum to the file from DSWM regarding the Holt well sampling seemed to center around Mr. Tom Moss' concerns and the conclusions made by U.S. EPA. The memorandum stated that because EPA had already completed a site investigation, that they (EPA) would continue with "their chosen course of action," and that "if Mr. Holt is concerned about possible health risks in using his well water between now and June (when EPA's priority decision is made), that he should rely on bottled or city water for cooking and drinking purposes until he is convinced that his well water is safe." Source: Memorandum to the file from Ms. Debbie Sanders, DSWM (U. S. EPA, Disk 1).

May 13, 1992 — A geotechnical and hydrogeological investigation report was prepared for the proposed landfill site. The report discusses the results of six borings on a 35-acre site. The purpose of the investigation and report was to meet the "Hydrogeologic Report" requirements outlined in TDHE DSWM Rule 1200-1-7-.04(9)(a). Notable report conclusions include the following: the soil was suitable as the landfill buffer zone; the uppermost aquifer occurs within 20 to 50 feet the Warsaw Limestone Formation; the three existing on-site wells are suitable to monitor the water moving through the overburden recharging the underlying bedrock; and additional private well and stream monitoring points should be added. Source: Geotechnical and Hydrogeological Investigation report, ATEC Associates, Inc., May 13, 1992 (DSWM, NEAC).

The conclusions presented in the report conflict with the following technical information provided in the report: wells or borings did not penetrate bedrock and, therefore, the first water-bearing zone is not in the Warsaw Formation, as stated; and soil boring log information indicates that a water-bearing zone at approximately 35 feet below ground surface, well above the boring termination and above the top of bedrock. The report states that the wells "are suitable to monitor water moving through the overburden...." It also states that there is an "undefinable groundwater flow direction in the overburden using these wells."

August 7, 1992 — The site inspection prioritization (SIP) report for the landfill was submitted to the U.S. EPA. The report concluded that a limited further investigation should be performed, focusing primarily on the additional characterization of the "possible southern drainage pathway." The attached scoring sheets for one scenario resulted in an overall score of 15.40. The scenario assumed a "low waste quantity value, a low Level I population value for the groundwater pathway, and the lack of an observed release to a perennial surface water body." The second scenario resulted in a score less than the cutoff score (28.5) because of the "limited number of people utilizing the well for drinking water." Both scenarios assumed a population of six was exposed to constituents above the MCL and that the municipal water well only served 3 percent of the annual yield. Source: Site Inspection Prioritization (SIP) Report, Dynamac Corporation, August 7, 1992 (U.S. EPA File)

The report did not consider that the municipal water well was used exclusively (along with City Lake) during certain 6-month periods of the years, and that the Piney River intake served most of the population.

October 1992 — A report on the modifications for the synthetic liner and leachate collection report was prepared to discuss the specifications of the liner and leachate collection system at the new balefill. The portion of the design that addresses the geologic buffer defaults to a previously prepared geotechnical report (ATEC Report May 13, 1992). The report recommended a maximum 20 feet depth of cut in the design "so that there will be a minimum of 20 feet of soil above the bedrock" based on ATEC's conclusion that the first water-bearing zone is in the bedrock. Source: Modifications for Synthetic Liner and Leachate Collection report, Gardner Engineering, October 1992 (DSWM, NEAC).

October 1, 1992 — TDEC memorandum that discusses the Holt well and the Dickson County Landfill. The DSWM transmitted a copy of an EPA scoring report. The DSWM stated that the report "scoring was based on Dickson's City Lake and wells being used for the city's drinking water supply. Approximately 2 years ago, the city discontinued using the lake and wells, relying on a water intake on the Piney River several miles away. When I learned of this, I relayed that information on to EPA. With that consideration, the site will be referred back to the state since it won't come close to ranking on the NPL". Source: Memorandum to Tom Moss, DWS from Allen Spear, DSWM, October 1, 1992 (DSWM, NEAC).

February 23, 1993 — Remedial Site Assessment Decision reevaluated the landfill scoring after "exhaustive" efforts to determine the additional waste volume yielded little information. The site "still does not score via the primary threat: groundwater pathway. Surface water pathway scenario for observed release of MN will not score site due to new SCDM value for BCF of 0.5. Site scores only 20." Source: Remedial Site Assessment Decision by Loften Carr, U.S. EPA (U.S. EPA file).

July 1, 1993 — Report submitted for the March 1993 (first semi-annual) sampling event for two wells (MW-2 and MW-4) of the four on-site wells and two springs (Donegan and Sullivan). Source: Letter of Revised Groundwater Monitoring Report for Dickson Landfill by Gardner Engineering to Alan Spear, DSWM (DSWM, NEAC).

The report did not include potentiometric surface maps, nor was any determination or comparison made for the results. The samples were analyzed for "pH, TCl, sp. cond., chromium (+6), TOC, NO2-N, TCr, Fe, Pb, Cd, and Mn."

January 5, 1994 — Letter from Gardner Engineering to DSWM requesting that Sullivan Spring be used as an upgradient water quality source for the landfill monitoring system. Source: Letter from Bob Gardner, P.E. of Gardner Engineering, to Alan Spear, DSWM, January 5, 1994 (DSWM, NEAC).

February 17, 1994 — A request from Gardner Engineering for a proposed new Class IV demolition landfill area in area where a steep ditch occurs between the old "closed out" landfill and the "present active landfill area." The reason for the request is that the area is difficult to maintain, given its steep slope. Source: Letter from Letter from Bob Gardner, P.E. of Gardner Engineering, to Doye Rowland, DSWM, February 17, 1994 (DSWM, NEAC).

March 5, 1994 — The results of the first quarterly sampling event for Sullivan Spring provided to the TDHE. The sample was collected below the surface, in a pool within 5 feet of the mouth of the spring. The results identified TCE at 18 µg/L and cis-1,2-Dichloroethylene at 5 µg/L. (Ref. Gardner Engineering letter to TDSWN- Sept. 30, 1994) Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

April 6, 1994 — A letter transmitting the analytical report for the "first annual" groundwater sampling event completed on March 5, 1994. The event used the "new parameters of analysis, as required." The sampling event was for two wells (MW-2 and MW-4 and two springs (Donegan and Sullivan). The Donegan Spring sample was analyzed for pH, temperature, TCl, specific conductivity, chromium (+6), total organic content (TOC), NO2-N, TCr, Fe, Pb, Cd, and Mn." The samples from MW-2, MW-4, and Sullivan Spring were analyzed for VOCs and various inorganics. The Sullivan Spring results indicated TCE at 18 µg/L and cis-1,2-dichloroethene at 5 µg/L. Source: Letter of Groundwater Sampling Results, Dickson Landfill, by Gardner Engineering to Alan Spear, DSWM (DSWM, NEAC).

A potentiometric surface map was not included in the report, nor was any determination or comparison made for the results.

June 25, 1994 — The second quarterly sampling event was conducted for Sullivan Spring. The sample was collected below the surface and in a pool of water within 5 feet of the mouth of the spring. The results indicated TCE 83 µg/L and cis-1,2-dichloroethylene at 19 µg/L. (Ref. Gardner Engineering letter to TDSWN- Sept. 30, 1994) Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

July 14, 1994 — Leachate remediation plan submitted for review at a show cause meeting. The plan was approved by the Division, and the facility began remediation. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

July 27, 1994 — A letter of transmittal for the analytical report for the groundwater sampling event completed on June 25, 1994. The sampling event was for two wells (MW-2 and MW-4) and two springs (Donegan and Sullivan). Sample results from Sullivan Spring indicated the following: TCE at 83 µg/L, cis-1,2-dichloroethene at 19 µg/L, and 1,2-dichloroethene at 19 µg/L. Donegan Spring was not sampled for VOCs. Source: Source: Letter of Groundwater Sampling Results, Dickson Landfill, by Gardner Engineering to Doye Rowland, DSWM (DSWM, NEAC).

August 28, 1994 — Second Sampling Event for Appendix 1 of .04 (Ref. Gardner Engineering Report, Nov. 4, 1994). Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

Sept. 1, 1994 — A sampling event was conducted to confirm that Sullivan Spring was contaminated. Analysis was requested for trichloroethylene, cis-1,2-dichloroethylene, and 1,2-dichloroethylene. The results indicated trichloroethylene at 59 µg/L, cis-1,2-dichloroethylene at 98 µg/L, and dichloroethylene at 98 µg/L.

Sampling was also conducted at locations up- and downgradient of Sullivan Spring. The results indicate the following:

At Furnace Hollow Creek, approximately 30 feet upstream of Sullivan Spring, all parameters were found to be below detectable levels.

At Furnace Hollow Creek, approximately 50 feet below Sullivan Spring, TCE was detected at 20 µg/L, other parameters found below detectable levels. (Ref. Gardner Engineering letter to TDSWN- Sept. 30, 1994) Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

Sept. 2, 1994 — Letter to Division of Water Pollution Control from Gardner Engineering confirming a telephone conversation relative to "a spring near the landfill site that has been found to contain levels of certain chemicals above the MCL." The results of the March and June sampling results for VOC detections were provided. In addition, Sullivan Spring was identified as being a drinking water supply for two residents. Mr. Jim Lunn, Landfill Operator, apparently notified the two residents on September 2 that "they should not use the water for drinking until further notice." The letter also states that other springs and wells in the area would be evaluated and that investigative work to determine the source would be done with the DSWM. Source: Letter from Gardner Engineering to Joe Holland, DWPC (DSWM, NEAC).

Sept. 2, 1994 — Information from Dickson County Landfill indicating that the facility is adversely affecting groundwater quality at and around the site. Sampling data from May 5, 1994, and June 25, 1994, indicate organic contamination in a spring being used as a drinking water supply. An NOV was issued to the Dickson County Landfill on September 9, 1994. The landfill was ordered to complete the following: the landfill shall immediately institute an assessment monitoring program. If the results of the assessment monitoring indicate that corrective measures are necessary, the landfill shall comply with all relevant requirements of the Division Rules 200-1-7-.04(7)(a)9, "Assessment of Corrective Measures," 1200-1-7-.04(7)(a)8, "Selection of a Remedy," and 1200-1-7-.04(7)(a)9, "Implementation of Corrective Action," within the required periods set forth within the respective Division Rules. Civil penalty of $34,200. (Ref. State of Tennessee Department of Environment and Conservation Commissioner's Order, Jan 23, 1995) Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

Sept. 6, 1994 — A sampling event was conducted to determine if West Piney River showed contamination. Samples were collected from four locations and analyzed conducted for TCE and DCE.

A sample identified as "Upstream of Topo Blue Line" indicated TCE at 8 µg/L. The Blue Line is the hollow from the landfill sediment pond discharge as it feeds into Furnace Hollow Creek.

A sample collected downstream of Topo Blue Line indicated TCE at 8 µg/L. The sample collected at Furnace Hollow Creek just prior to joining West Piney did not contain TCE or DCE. A leachate sample taken from old closed out landfill area did not contain TCE or DCE. (Ref. Gardner Engineering letter to TDSWN, Sept. 30, 1994) Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

Sept. 7, 1994	Sampled drinking water used for all (eight) residences on Furnace Hollow Road and Dale Donegan Spring. Most samples were taken from the kitchen sink. Donegan Spring sample taken from below surface in pool near mouth of spring. All samples were found to be below detection limit for TCE and cis-1,2-DCE (Ref. Gardner Engineering letter to TDSWN, Sept. 30, 1994) Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
Sept. 8, 1994	Letter of notification sent to Mrs. Ann Sullivan and Mrs. Kay Stewart regarding presence of TCE and cis-DCE, and 1,2-DCE. The recommendation included discontinued use of the spring as a drinking water source. Ref. Letters from State of Tennessee, Dept. Of Environment and Conservation) Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
Sept. 9, 1994	An NOV was given to the landfill for violation of the Division's groundwater protection standard and the maximum contaminant levels for TCE and DCE. The NOV was issued as a result of analytical results from Sullivan Spring (cis-1,2-dichloroethylene [0.019 mg/L]), trichloroethylene [0.083 mg/L], and 1,2-dichloroethylene [0.029 mg/L]). (Ref. Letter from State of Tennessee, Dept. Of Environment and Conservation) Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
Sept. 16, 1994	Water from the Evans residence was sampled. This residence was thought to be on city water, but resident claims he is on well water. TCE and cis-DCE were below detection limits. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
Sept. 30, 1994	Letter summarizing the results of stream, spring, and well sampling was provided to the DSWM. Detections of TCE, cis-1,2-dichloroethene, and 1,2-dichloroethene were reported in Sullivan Spring, the hollow from the landfill sediment pond, and Furnace Hollow Creek. Samples collected from Furnace Hollow Road residential wells were all non-detect for TCE and cis-1,2-dichloroethene; however, these were the only two constituents reported by the laboratory at the request of Gardner. Other samples were collected from surface waters and analyzed only for the TCE and cis-1,2-dichloroethene. The detection limit was not the method practical quantitation limit, but "0.005 mg/L"; therefore, only those samples with a value equal to or greater than the MCL for TCE would have shown a detection. The well samples were not analyzed for 1,2-dichloroethene although it was detected in Sullivan Spring along Furnace Hollow Road. Source: Letter to Jason Repture, DSWM from Bob Gardner, P.E., Gardner Engineering (DSWM, NEAC).
October 4, 1994	Letter from Gardner Engineering to Mr. Jason Repture responding to a September 9, 1994, letter to the Dickson County Landfill. The letter included a map of sampling locations and stated that "groundwater contours are not shown due to insufficient information". Source: Letter to Jason Repture, DSWM from Mark Gardner, P.E., Gardner Engineering (DSWM, NEAC).

October 10, 1994 Letter from Mr. William Field, Dickson County Executive stating that the County will "comply with the DSWM's requirements for conducting a Groundwater Assessment." Griggs and Maloney was retained to develop the plan. Source: Letter from William Field, Dickson County Executive to Al Majors, DSWM, October 10, 1994 (DSWM, NEAC).

October 13, 1994 City conducted sampling of well DK-21. Analysis indicates that no VOCs were detected above detection limits. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

November 1994 A groundwater quality assessment plan was developed to determine if "solid waste constituents have entered the groundwater; and characterization of the concentrations and rate and extent of migration of waste constituents in the groundwater." The work proposed included the installation of three wells between the landfill and Sullivan Spring and the identification of springs, streams, and domestic and commercial wells in the area. The report concluded that the direction of groundwater flow in regolith "may be discontinuous." The proposed well installation method is the use of hollow-stem augers through the soil, with split spoons being collected every 10 feet. In the event bedrock drilling is necessary, air rotary drilling will be performed, and a surface casing will be placed "in order to seal off the soil aquifer." Source: Groundwater Quality Assessment Plan, Griggs and Maloney, Inc., November 1994 (DSWM, NEAC).

November 4, 1994 Letter with attached groundwater results for a September 24, 1998, sampling event. No potentiometric surface determination was made, nor was any determination or comparison made for the results. TCE (0.084 mg/L) and cis-1,2-dichloroethene (0.017 mg/L) were detected in Sullivan Spring. Chloroethane (0.004 mg/L) and chloromethane (0.006 mg/L) were detected in well MW-2. Source: Letter to Jason Repture, DSWM from Bob Gardner, P.E., Gardner Engineering (DSWM, NEAC).

Nov. 28, 1994 Groundwater Quality Assessment Plan (Ref. Letter from State of Tennessee, Dept. Of Environment and Conservation) Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

December 9, 1994 Approval of Groundwater Assessment Plan. (Ref. Letter from State of Tennessee, Dept. Of Environment and Conservation) Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

January 23, 1995 A Commissioner's Order was issued as a result of inspections conducted in 1993 and 1994. An inspection on December 17, 1993, indicated numerous major and minor leachate seeps and flow on both the closed and active portions of the facility. Intermediate cover was not being applied every 30 days as required by the permit. Water was being allowed to pool on the facility. Erosion on the slopes had exposed wastes. Notice of Violation issued on 12/29/93, requiring compliance by 01/18/94.

Inspection on 01/26/94 also indicated numerous major and minor leachate seeps and flows. Intermediate cover on the vertical face of the bales was not being maintained in accordance with permit requirements. Erosion was widespread.

March 14, 1994: Compliance Review Meeting at the Nashville field office.

March 17, 1994: Division sent a letter that outlined issues discussed and the compliance dates set. Inspection on 03/31/94: Erosion, leachate, and intermediate cover repairs were incomplete. Inspections on 04/22/94 and 05/23/94: Continuing violations. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

February 1995 — An investigation is conducted by the U.S. Geological Survey (USGS), in cooperation with Dickson County Solid Waste Management, to determine local groundwater altitudes and to determine if Sullivan Spring is hydraulically downgradient of the Dickson County Landfill. This investigation was part of an ongoing effort to understand the hydrology and groundwater interaction at landfills along the Highland Rim Physiographic region of Tennessee. Five monitoring wells were installed near the previously unmonitored northwestern corner of the landfill between the landfill and the spring. Water levels were measured in the 5 new wells and 10 local wells to determine the direction of groundwater flow in the area. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

February 20, 1995 — Letter of transmittal for the groundwater monitoring results December 26, 1994. No potentiometric surface determination was made, nor was any determination or comparison made for the results. Furthermore, only wells MW-2 and MW-4 were analyzed for VOCs. Chlorobenzene was reported in MW-4 (0.004 mg/L). "Appendix II" results for Sullivan Spring did not include VOC or metals analyses. Cadmium (0.0067 mg/L) in Sullivan Spring exceeded the MCL. Source: Letter to Jason Repsher, DSWM from Bob Gardner, P.E., Gardner Engineering, (DSWM, NEAC).

July 1995 — Gresham, Smith and Partners initiates cover system and leachate generation rate calculations. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

August 1995 — The Groundwater Assessment Report was submitted to the DSWM. The report summarized the sampling results for five new wells to the northwest. Three "deep rock" wells were installed into bedrock, and two "shallow" wells are assumed to be in the residuum. The report summarized the monitoring of the five new wells and the results of well MW-1, the only previously existing well that was sampled. Wells MW-2 and MW-4 were not sampled. No details of the well installation protocol or boring conditions were provided. The report concluded that the direction of groundwater flow for the shallow wells was to the southwest and that the direction for the rock wells was to the northwest. (There is reason to believe that these determinations are not correct). The analytical results were provided for Appendix I constituents only. Furthermore, some VOC reporting limits were greater than the method PQL, and some were reported at the MCL (e.g. TCE). No results were provided for off-site springs. In addition, no results for the spring and well use search were provided (assuming these were performed). Source: Groundwater Assessment Report, Griggs and Maloney, August 1995 (DSWM, NEAC).

August 1995 — Gresham, Smith and Partners completes evaluation of old cap; estimates of 500,000 gallons per acre of leachate generation per year with existing cap. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

August 15, 1995 — Memorandum to Dickson County from EPA notifying that the landfill had been removed from the CERCLIS list, as part of the EPA Brownfields initiative. Source: Memorandum from Matthew Robbins of EPA to the landfill, August 15, 1995 (DSF, NEAC).

Unknown 1996 — The USGS issues a report summarizing the well installations that were completed in 1995 in apparent response to the Groundwater Assessment Plan implementation by Griggs and Maloney on behalf of the county. Five wells were installed to the northwest "to determine the local groundwater altitudes and to determine if Sullivan Spring is hydraulically downgradient from the Dickson County Landfill." All soil borings for the wells were advanced with an air rotary drill rig. The surface casing for well MW-6 (a bedrock well) was not fully grouted into place. A "large void" was encountered in well MW-8. The report concluded that the altitude of Sullivan Spring "was lower and hydraulically downgradient from water level altitudes in all of the monitoring wells at the landfill." The report further concluded that the "wells in topographically high areas had higher water altitudes than wells near major streams." Source: USGS report "Construction, Lithologic, and Water-Level Data for Wells Near the Dickson County Landfill, Dickson County, Tennessee, 1995", 1996 (DSWM, L&C Tower).

January 1996 — Gresham, Smith and Partners conducts leachate treatment pilot tests to provide alternate to pump, and, haul leachate treatment method. Approval granted by TDEC for innovative treatment. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000 TDEC NEAC (DSWM, NEAC).

January 22, 1996 — Gresham, Smith and Partners submitted a proposed approach for treating leachate. A dual-phase extraction system was proposed to "withdraw and aerate the leachate from the leachate sump and wells." An ultraviolet treatment system was proposed to treat the water, and a constructed wetland was proposed to reduce the remaining biological oxygen demand. The system was expected to treat 14,000 gallons per day. A pilot system was proposed prior to full-scale implementation. Source: Letter from Jason Repsher of Gresham, Smith and Partners to Mark McWhorter, DSWM, January 22, 1996 (DSWM, NEAC).

January 31, 1996 — Letter to the DSWM stating that well top of casing elevations used for the July 25 and 26 monitoring event were incorrect. Source: Letter from Griggs and Maloney to Al Majors, DSWM, January 31, 1996 (DSWM, NEAC).

March 1996 — Ferguson Harbor contracted by Dickson County to provide treatability study on cavitation/oxidation (CAV/OX) design for leachate treatment. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

March 11, 1996 — Memorandum to DSWM file stating that the DSWM is in "full support" of the proposed leachate collection and treatment effort for the "closed portion" of the Dickson County Landfill. Source: Memorandum by Glen Pugh to Ken Bunting, Bureau of Environment, March 11, 1996 (DSWM, NEAC).

March 31, 1996 — A letter to Dickson County requesting a meeting to "discuss past events at the site with you and your consultant, as there seems to be some gaps in the information contained in our file concerning the site." The letter further states that the site was "put into Assessment during September 1994 based on the presence of 3 parameters found to be above MCLs." At the time of the memorandum, the only Assessment monitoring (Appendix II) sampling results were submitted in August 1995. The letter further states that "the presence of these contaminants in the spring suggests a hydraulic connection between the Sullivan Spring and the landfill." Also, the letter identifies the "new domestic well adjacent to the Sullivan spring" as being a concern and that "follow-up sampling" of two additional domestic water supplies may be required. Source: Letter from J.L. Fottrell, DSWM to Jim Lunn, Dickson County, May 31, 1996 (DSWM, NEAC).

June 1996 — Sullivan Spring results still indicate TCE. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

July 22, 1996 — Letter from TDEC to Jim Lunn outlining what steps "should be taken in order to bring the Dickson County Landfill into compliance." The landfill was to have begun assessment monitoring in September 1994. The DSWM requested that a groundwater monitoring plan be submitted; the landfill resume Appendix I monitoring; a domestic water supply inventory for a 1.0-mile radius be submitted; and that wells 1, 2, 4, 6, 7, 8, 9, and 10 and the Sullivan Spring be sampled. The report was to be submitted by August 30, 1996. Source: Letter from J.L. Fottrell, DSWM to Jim Lunn, Dickson County, July 22, 1996 (DSWM, NEAC).

August 28, 1996 — Letter from Griggs and Maloney to the DSWM providing the results of a "drive-by survey" of domestic water wells within a 1.0-mile radius. The letter also stated that a new well had been installed to supply the residences that previously used Sullivan Spring as a water supply. Source: Letter from Griggs and Maloney to J.L. Fottrell, DSWM, August 28, 1996 (DSWM, NEAC).

September 1996 — A groundwater monitoring report submitted to the DSWM. The report summarized the results of an August 19 and 21, 1996, sampling event. The report summarized the results of samples collected from wells MW-1, MW-2, MW-4, MW-6, MW-7, MW-8, MW-9, and MW-10, and Sullivan Spring. Cadmium was detected in all wells from which a sample was analyzed and in Sullivan Spring at concentrations in excess of the MCL. The report had analytical detection limits at or above some MCLs (e.g. methylene chloride). Potentiometric surface diagrams were prepared for the shallow wells (flow to the northwest) and the bedrock well (flow to the northwest). Samples were not analyzed for Appendix II parameters. No domestic well sample results were provided. No statistical evaluations of the results were performed. Source: Groundwater Monitoring Report, Griggs and Maloney, September 1996 (DSWM, NEAC).

October 1996 — TDEC indicates that a corrective measure must be implemented to mitigate leachate outbreaks and control off-site migration of contaminants to groundwater. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

October 14, 1996 An NOV was issued because the previously submitted groundwater monitoring report indicated an MCL had been exceeded for cadmium. The letter required the county to establish an assessment monitoring program, conduct quarterly sampling for Appendix II constituents, and initiate corrective actions within 90 days of having found any constituent with a statistically significant increase. The future sampling regime was to include wells MW-7 (shallow), MW-8 (bedrock), and MW-9 (shallow). Construction information was to be provided for wells MW-2 and MW-4. Well MW-1 was deleted from the sampling requirement because it apparently did not provide adequate sample volume for all parameter analyses. Wells MW-1, MW-6 (bedrock), and MW-10 (bedrock) were to be used for water level measurements only. Source: Letter from J.L. Fottrell, DSWM to Jim Lunn, Dickson County, October 14, 1996 (DSWM, NEAC).

October 15, 1996 A letter from TDEC to Dickson County was submitted after TDEC's review to "determine if the possibly of contamination exists in the domestic water supply well at the Sullivan residence." Water level interpretations indicate that the screened intervals for wells MW-6 (bedrock), MW-8 (bedrock), and MW-10 (bedrock) were all below the elevation of Sullivan Spring. Previous sampling results had indicated that each of these wells exceeded the MCL for cadmium. Therefore, the letter implies that the contamination had no downgradient monitoring point. The letter requested that information on the construction specifics of the Sullivan well be obtained and the Sullivan well be sampled for Appendix I parameters, with the data being submitted by November 22, 1996. Source: Letter from J.L. Fottrell, DSWM to Jim Lunn, Dickson County, October 15, 1996 (DSWM, NEAC).

November 1996 Dickson County requests additional time to comply with DSWM to study additional leachate treatment methods. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

Nov. 7, 1996 A revised groundwater monitoring report for the August 19 and 21 sampling event submitted to the DSWM. The report made reference to having "corrected laboratory certificates." Source: Revised Groundwater Monitoring Report, November 7, 1996 (DSWM, NEAC).

Dec. 26, 1996 A letter from Griggs and Maloney to the DSWM indicating the results of samples collected from the Sullivan well. The report stated that there "were no parameters detected above the regulatory limits." The parameter report limits were slightly less than the MCLs. Source: Letter from Griggs and Maloney to Lennie Fottrell, DSWM, December 26, 1996 (DSWM, NEAC).

April 1997 TCE detected in public water supply well DK-21, Dickson water well. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

April 17, 1997 — A groundwater monitoring report received by the DSWM for the February 12 and 19, 1997, sampling event. The report summarized the sampling results for wells MW-2, MW-4, MW-6, MW-7, MW-8, MW-9, and MW-10 and Sullivan Spring. Water levels and samples were collected on two separate days. The results indicated five inorganic parameters (beryllium, cadmium, chromium, lead, and nickel) above regulatory limits. The report stated that the groundwater flow direction for the shallow wells is to the northwest and for the bedrock wells is to the southwest. Source: Groundwater Assessment Report, Griggs and Maloney, April 1997 (DSWM, NEAC).

June 12, 1997 — A letter from Griggs and Maloney received by the DSWM for Sullivan Spring. TCE (0.23 mg/L) and cis-1,2-dichloroethene (0.031 mg/L) were detected. Source: Letter from Griggs and Maloney to Lennie Fottrell, DSWM, June 10, 1997 (DSWM, NEAC).

June 12, 1997 — A "formal request" letter from the DSWM inquiring about the status of remedial activities. The letter states that leachate outbreaks "from time to time" move into the surface water runoff ditch, which flows into the silt pond (*past data indicated VOCs from the discharge of this pond*). The letter states that the remedial pilot study had been completed and that the remediation plan "should be presented no later than August 1, 1997." Source: Letter from Mark McWhorter, DSWM to Jim Lunn, Dickson County, June 12, 1997 (DSWM, NEAC).

June 30, 1997 — A closure/post-closure plan (revised February 1997) for the balefill received by the DSWM. The report described actions for closure, post-closure inspection and monitoring, and groundwater monitoring. Operations were reported to have stopped at the balefill in October 1996. The proposed groundwater monitoring plan did not include Appendix I sampling "unless directed by the DSWM or unless it appears that the groundwater may be subject to contamination." The report stated that quarterly methane gas monitoring would be performed and reported quarterly to the DSWM. Source: Closure/Post Closure Plan (revised February 1997), Griggs and Maloney, June 1996 (revised February 1997) (DSWM, NEAC).

July 1997 — Tennessee Valley Authority (TVA) discusses leachate treatment with TDEC. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

August 1997 — Meeting with TDEC DSWM, USGS, and Gresham, Smith and Partners to discuss the use of a dye study at the landfill. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

August 5, 1997 — Letter from Griggs and Maloney to the DSWM that included details of a leachate withdrawal well and a geosynthetic clay liner installation of an existing ditch. The letter did not discuss the dual-phase treatment scheme or the constructed wetland. Source: Letter from Griggs and Maloney to Ebrahim Almassi, August 5, 1997 (DSWM, NEAC).

August 27, 1997	Letter from Gresham, Smith and Partners to the DSWM proposing a "proactive approach in dealing with the situation" at the landfill. The letter proposed a dye trace "for the identification of the migration pathways beneath the Dickson County Landfill area and the implementation of a wetland treatment system to treat the leachate within the landfill." There were no details of either approach. The letter requested that permission be obtained for a pilot-scale constructed wetland treatability study. Source: Letter from Jason Repsher and Joe House to Lennie Fottrell, DSWM, August 27, 1997 (DSWM, NEAC).
Dec. 31, 1997	A work plan for a proposed dye study provided to the DSWM by the USGS. In addition, a dye trace registration form was attached. The work plan proposed that the dye trace be conducted in two phases, with the first beginning on December 2, 1997, and the second beginning January 6, 1998. The proposed dye trace suggested the use of three wells: Di: F-86 (unknown well) and two landfill wells (also unknown identification). The study proposed the use of three dyes. Source: Letter from David Ladd, USGS, to Lennie Fottrell, DSWM (DSWM, NEAC).
Dec. 31, 1997	A dye trace registration form submitted by the USGS to the DSWM. The form formalized the request for the trace with the DSWM. Source: Form from David Ladd, USGS to Scotty Sorrells, DSWM, December 31, 1997 (DWS, L&C Tower).
December 1997	Background for dye study initiated, USGS submits dye study work plan to TDEC. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
January 1998	USGS began a dye study in cooperation with Dickson County. Three known dyes were introduced into the subsurface at two discreet locations within the footprint of the landfill and in well MW-1A. Monitoring of the study continued for approximately 1 year after the injection of the dyes. Although the USGS claims to have a positive detection of the dyes within monitoring well MW-8, it did not proclaim any proof or disproof of a hydraulic connection between the landfills and Sullivan Spring. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
March 18,1998	Private water wells sampled for VOCs--Dunley, Petty, Hampton, Evans, and Pentacost wells sampled with no detects. Holt well (Cemetery Road well on log) nondetect on April 8, 1998. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
April 7, 1998	An NOV/compliance evaluation inspection given to the DSWM. The letter states that the Tennessee Multi-Sector General Permit was violated because leachate was being discharged through Outfall 003 without a permit. The letter required that Dickson County "immediately take action to terminate the discharge." The facility also was in violation for failing to "properly implement and/or modify the facility Storm Water Pollution Prevention Plan." An outline of corrective actions to meet "full compliance" was due within 4 weeks of receipt of the letter. Source: Letter from Robert Karesh, DWPC to Jim Lunn, Dickson County, April 7, 1998 (DSWM, NEAC).

May 12, 1998	Update to DSWM: pond discharge to be sampled due to possible leachate outbreak. Based on May 6th letter to Dickson County from TDEC. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
June 1998	Groundwater sampling event by Griggs & Maloney, Inc. No VOCs detected in groundwater monitoring wells. Sullivan well also shows no VOCs. Sullivan Spring indicated 22 µg/L of cis-1,2-dichloroethene and 140 µg/L of trichloroethylene. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
September 1998	Dye trace study field activities to conclude. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
February 23, 1999	Data received from USGS by Gresham, Smith and Partners on public water supply well DK-9. Depth 340 feet bgs. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
March 3, 1999	Meeting Notes: TDEC-DSWM, USGS, Gresham, Smith and Partners, and Dickson County Solid Waste. Data logger to be placed within Sullivan Spring. Sample Sullivan Spring for Appendix II parameter list, pump tests to be conducted, new groundwater plan to be completed after review of data. Upon formal reporting of pump studies, the assessment of corrective measures will continue with presumptive remedies, (i.e. capping), based on TDEC DSWM guidelines. Survey work is nearing completion. Design of leachate collection system is underway. Sewer tap requested by Dickson County to tie into City of Dickson sewer system to dispose of leachate. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
April 8, 1999	Survey information completed. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
April 12, 1999	An NOV received by City of Dickson for inadequate depth of cover and pooling of water on the cover. City of Dickson must prepare a plan of corrective actions by June 1, 1999. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
May 17, 1999	Well MW-8A drilled to allow for pumping test of large conduit/aquifer. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
May 20, 1999	Letter from Janet Harris, Dickson County Executive, requesting that the state's camera logging truck be used to "assist the citizens of Dickson County" to "provide invaluable information as to the possible direction of groundwater flow, dip of the rock strata, fracture patterns, and joint set patterns." The camera was requested to evaluate a new well installed on May 18, 1999. The well was located "in the vicinity of the landfill" to be used "to replace impacted drinking water supplies in the area or perhaps as irrigation water for the landfill cover vegetation." Source: Letter from Janet Harris, Dickson County Executive to Luke Ewing, DWS, May 20, 1999 (DWS, NEAC).

June 6, 1999	Bids for pump installation received. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
June 7, 1999	Video well log taken of well MW-8A. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
August 25, 1999	Bids received for construction of the leachate collection system at the unlined portions of the landfills. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
August 26, 1999	Groundwater sampling event; all monitoring wells below detection limits for VOCs: Sullivan Spring 39 µg/L cis-1,2-dichloroethene and 160 µg/L trichloroethylene in well MW-8A. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
Nov. 11, 1999	Dickson Electric System problems resolved. Meter to be set within the week for pump activation. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
Dec. 17, 1999	Electric line installed. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
Dec. 30, 1999	Receipt of a groundwater monitoring report for a groundwater sampling event conducted on August 26 and 27, 1999. Samples were collected from wells MW-1A, MW-2, MW-4, MW-6, MW-7, MW-8, and MW-9, and Sullivan Spring. The samples were analyzed for Appendix I parameters. The analytical report limits were lower than what had been reported in the past. TCE (0.16 mg/L) at the Sullivan Spring exceeded the MCL. Cis-1,2-dichloroethene was reported at the spring at 0.039 mg/L. A statistical analysis was not performed on the sample results. Although the wells were reported to have been sampled on August 26 and 27, the field data sheets indicate that the wells were sampled and purged and sampled on July 13 and 14. The report identified two groundwater aquifers on-site, with one being in the regolith (flowing to the northwest) and one in the bedrock (flowing to the west-southwest). The report stated that "interconnection between these aquifers is likely but the extent of which has not been determined." Source: G,S&P August 1999, (DSWM, NEAC).
January 12, 2000	Easement issues arise for the installation of the forcemain of the leachate collection system. Construction delayed. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
January 20, 2000	First pumping test of landfill monitoring well MW-8A. Samples for TCE in well MW-8A after test were below detection limits. Sullivan Spring at 130 µg/L TCE and 28 µg/L cis-1,2-dichloroethene. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).
February 25, 2000	Second pumping test of well MW-8A. Samples for TCE in well MW-8 after test were below detection limits. Sullivan Spring at 81 µg/L TCE and 18 µg/L cis-1,2-

dichloroethene. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

April 2000 — The results of the dye study conducted at the landfill are included in Appendix B of a report prepared by Gresham, Smith and Partners. The report was prepared by the USGS. The background of the report states that well DK-21 is used as a municipal water supply from "generally December to April" of each year. During that time, there "may be as much as 40 feet of drawdown in the well." Background dye receptors were placed from December 2, 1997, to January 13, 1998, to aid in choosing dyes for injection. Dye detectors were retrieved every 1 to 2 weeks. The dye injection phase was conducted from January 13 to September 29, 1998. Three dyes were injected into three wells at the landfill. Cotton and charcoal detectors placed at 25 sites were initially collected and analyzed "every couple of days," but were later collected every 3 weeks at the end of the study. The detection sites generally consisted of the municipal well DK-21, numerous springs, at least one private well, and on-site wet areas and sumps. No receptors were installed at either of the Holt wells located to the southeast. Tinopal CBS-X (an optical brightener), Rhotamine WT, and Eosine OJ were the three dyes. The three injection points were as follows: Well Di:F-91 (seems to correspond to well MW-1 or MW-1A), a county landfill leachate well (LW-4) installed in the waste, and a city landfill leachate well (also presumed to be installed into waste). The USGS reported a positive detection in Site 8 (presumed to be well MW-8) on January 14 from the Optical brightener that was injected into Well Di:F-91. No other dyes were detected at the other 24 sites. Source: Appendix B, TCE Investigation Report, Gresham, Smith and Partners, April 2000 (DWS, L&C Tower).

April 2000 — Gresham, Smith and Partners completes pump test studies of well MW-8, documents findings to TDEC DSWM. Study results are inconclusive regarding a direct link but eliminate several other possibilities. Evidence growing that landfill is influencing Sullivan Spring. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

June 13, 2000 — Industrial user permit sent to the City of Dickson sewer department for approval of leachate discharge to the sewer system. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

August 14, 2000 — Change order signed between Dickson County and contractor to finish leachate collection system. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

September 2000 — A groundwater monitoring report prepared by Gresham, Smith and Partners summarizing the results of a sampling event conducted on September 20, 2000 (Sullivan Spring only) and September 26, 2000 (the on-site monitored on a different day). The samples for wells MW-1A, MW-2, MW-4, MW-6, MW-7, MW-8, MW-9, and MW-10, and Sullivan Spring were analyzed for Appendix I constituents. The MCL for TCE (0.16 versus 0.005 mg/L) was exceeded at Sullivan Spring. Cis-1,2-dichloroethene was also reported in the spring (0.025 mg/L versus the 0.07 mg/L MCL). The report concluded "no other exceedances were reported."

Interesting points were made in the Gresham, Smith and Partners report. The report concluded that two aquifers are present, one at the top of bedrock and one within the bedrock). For the Class I Landfill, the report states "it is unlikely that any of the monitoring wells are upgradient of waste." Furthermore, the report states that for the Class IV Landfill, "a background monitoring point has not been established." The report is also contradictory in that the reported direction of groundwater flow from the shallow aquifer was to the north and northeast, although the potentiometric diagram reported the direction to the north and northwest.

Second, well MW-6 continues to be used as a bedrock monitoring point even though the well casing is suspected of leaking water from the upper aquifer (could artificially report higher groundwater elevations).

Third, well MW-8 was not purged but rather an adjacent well (MW-8A) was used to purge the well by removing 25,000 gallons (versus the 40 gallons for three well volumes) of water, which was apparently discharged to the ground surface. Furthermore, a pre-purge sample collected from well MW-8 exceeded the MCLs for cadmium, lead, mercury, and thallium. The justification of using well MW-8A to purge well MW-8 was that they are from the "same water-bearing zone." Well MW-8 is reported to be 176.90 feet deep, while well MW-8A is 240 feet. Next, no statistical analyses of the sampling results were performed. Last, although cis-1,2-dichloroethene was reported in the Sullivan Spring sample, the report concluded that "it is unlikely that they are in fact in the sample." Source: Groundwater Monitoring Report, Gresham, Smith and Partners, September 2000 (DSWM, NEAC).

Sept. 19, 2000 — Palind well sampled with no VOCs detected. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

Sept. 21, 2000 — Sullivan Spring sampled. Cis-1,2-dichloroethene detected at 25 µg/L and TCE at 160 µg/L. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

Sept. 25, 2000 — A summary memorandum prepared by Mr. Chuck Head, of the NEAC to Commissioner Hamilton and others within TDEC. The memorandum summarized events related to the Dickson County Landfill, the City of Dickson water supply, and the occurrence of orofacial clefts. Key points in the memorandum related to the use of the municipal wells, the regulatory status of the landfill, and sampling for TCE include the following:

- EPA decided in 1991 that no further action was required for the Holt wells.
- The City activated its lake/well source near the landfill in December 1991.
- Dichloromethane and TCE were detected in December 1996 in a well sample collected by the city. The report states that 0.032 mg/L TCE was reported in the well on February 24, 1997.
- The Division notified the city that the well could not be used as a source of water unless the raw water is treated with aeration.
- On April 18, 1997, the City decided not to use the well.
- The Division approved the treatment system in October 1998.
- Louis Burnett of DWS determined in a September 21, 2000, site visit that the well had been used again in March 2000 (March 6 to March 19).

- Results of Sullivan Spring sampling indicated constituents above the MCL.
- Sampling of a water well also owned by Mr. Sullivan indicated the presence of TCE.
- The TDH met with the parents of nine children with cleft palate.
- A well from the Pilate family (a family with a child with orofacial cleft) property was sampled by Dickson County during the week of September 25, 2000. TCE was "not found in the water from the well."

Source: Memorandum to Commissioner Hamilton of TDEC from Chuck Head, TDEC NEAC, September 25, 2000 (TDEC).

Sept. 26, 2000 — Groundwater monitoring wells sampled. Draft. Source: Timeline for Dickson County Landfill, originator unknown, October 3, 2000, TDEC NEAC (DSWM, NEAC).

October 3, 2000 — TDEC DSWM develops summary regulatory timeline for activities dating to 1968. Source: Timeline for Dickson County Landfill, TDEC NEAC (DSWM, NEAC).

October 9, 2000 — Sampling by the DSWM on October 9 and 10, 2000, indicated that methyl ethyl ketone was detected in well DK-21 (0.018 mg/L) and the Donegan well (0.012 mg/L), and trihalomethanes were detected at four residences. The memorandum discussed a possible health advisory needed "for MEK within 2,000 µg/L" (2 mg/L). Source: Sampling results from State of Tennessee Environmental Laboratories, to "Louis" from "Chuck", October 11, 2000 (DWS, L&C Tower).

October 16, 2000 — A table that reportedly summarizes October 9 and 10, 2000, sampling results (TCE only) for numerous wells (22 private, 2 municipal, and 1 irrigation) and three springs located near the Dickson County Landfill. TCE was reported in the Sullivan Spring (0.16 mg/L) and H. Holt well (0.12 mg/L). Ethylbenzene, toluene, 1,2,3-trimethylbenzene, and xylenes were reported in the J. (Lavenia) Holt well. Cis-1,2-dichloroethene was also reported in the H. Holt well (no concentration given). Source: Table, October 16, 2000, originator unknown (DSWM, NEAC).